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LLNL-CNS International Safeguards Policy and Information Analysis Summer Course

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Disclaimer

LLNL-CNS International Safeguards Policy and Information Analysis Summer Course

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Abstract:

Lawrence Livermore National Laboratory (LLNL) and the James Martin Center for Nonproliferation Studies (CNS) at the Monterey Institute of International Studies (MIIS) actively support U.S. Department of Energy National Nuclear Security Administration (NNSA) Next Generation Safeguards Initiative efforts to recruit and train the next generation of nuclear safeguards experts. Together, LLNL and CNS co-host the International Safeguards Policy and Information Analysis Summer Course. The week-long course covers the historical evolution of the legal and institutional foundations of international safeguards, approaches and technologies for safeguards implementation, and case studies of challenges to the international safeguards system. The course also features an exercise to simulate the International Atomic Energy Agency (IAEA) state evaluation process, and, new for the 2010 course, an exercise to simulate the drafting and negotiation of an IAEA Board of Governors resolution.

This presentation provides an overview of the goals and content of the course, describes the lessons learned and the refinements made to the course during the past three years, and discusses the course's role in training the next generation of safeguards experts.

Introduction:

Lawrence Livermore National Laboratory (LLNL) and the James Martin Center for Nonproliferation Studies (CNS) at the Monterey Institute of International Studies (MIIS) developed and produced the initial International Safeguards Policy and Information Analysis course in 2008. Through this partnership, the institutions leveraged respective expertise to create a substantive, robust course to educate the next generation of safeguards experts. CNS, internationally recognized as a leader in nonproliferation education, ensures that the course meets high academic standards, incorporates the most promising tools in nonproliferation education—including simulation exercises and online learning modules—and places emphasis on understanding the international context, while LLNL draws on its practical experience in nuclear safeguards implementation to help design the agenda and bridge the technology-policy gap, a critical challenge for international safeguards education. The course also benefits from the generous participation of experts drawn from other national laboratories, the IAEA, and the international safeguards community to present course lectures, facilitate simulations, and conduct other activities during the course.

The purpose of the course is to familiarize upper-division undergraduates, graduate students and young professionals with international nuclear safeguards policy issues to motivate and partially enable some of the participants to pursue international safeguards as a specialization in their nonproliferation careers. Whether course participants' goals include working at the national laboratories, in government, at the IAEA, or elsewhere, and whether their primary career interest lies in the technical or political arena, a strong grounding in international safeguards will aid them in making an effective contributions to the nonproliferation and safeguards field. Our course focuses on the history, evolution, and challenges in international safeguards policy, with an emphasis on the information analysis techniques used in the international safeguards evaluation process. Also, the course features two exercises that simulate different aspects of international safeguards activities to give students an active, participatory glimpse into the field, and to challenge them to consider safeguards issues through other perspectives.

The course is sponsored by the U.S. Department of Energy National Nuclear Security Administration (NNSA) Next Generation Safeguards Initiative (NGSI). NGSI is a robust, multi-year program designed to develop policies, concepts, technologies, expertise, and international infrastructure necessary to strengthen the international safeguards system as its mission evolves over the next 25 years. This course falls under NGSI's "Human Capital Development" subprogram, which seeks to preserve and expand the international safeguards expertise in the United States. For the past three years, course partners have educated 75 students and generated educational materials that can be used elsewhere; this partnership has become an important component to the overall NGSI Human Capital Development effort. Looking forward, LLNL and CNS intend to continue to sharpen the course to ensure that it remains a model offering in the NGSI academic program.

Course Goals:

The International Safeguards Policy and Information Analysis course is designed to present participants with general nuclear nonproliferation knowledge the specific history and evolution of safeguards policy and concepts, as well as an introduction to key safeguards technologies and approaches. With its twin focus on policy and on analyzing states' nuclear activities, and with the inclusion of two in-class simulation exercises, the course trains students not only to be sharp analysts of state nuclear programs, but also to be sensitive to the political issues that can influence the practice of international safeguards.

The LLNL-CNS course is not the only course sponsored by the NGSI Human Capital Development program. Also, the LLNL-CNS course does not claim to teach students all of the information necessary to achieve a comprehensive education in international safeguards. This course exists amongst other courses that vary in terms of their contents, length, focus, and geographic location. For example, other laboratories and universities have created courses or workshops geared more

towards science and engineering students. These programs have a greater emphasis on hands-on work with safeguards instrumentation and include laboratory exercises.

Course Audience and Career Positions:

In 2009, the students represented a variety of academic levels and disciplines; most were still in school, others were early professionals; the majority were Master's candidates in international relations programs with a focus on nonproliferation. The second largest discipline represented was nuclear engineering. Some students had a combination technical and policy academic background. Those participants who were early professionals included staff from the national laboratories, the IAEA, NGOs, and U.S. and foreign governments.

By the Numbers:

2008: 16 participants (10 male, 6 female) from nine countries
Schools and organizations included: MIIS, IAEA, University of California, (UC) Berkeley, University of California, Los Angeles (UCLA)

2009: 30 participants (15 male, 15 female) from six countries
Schools and organizations included: Harvard University, MIIS, U.S. Treasury Department (OFAC), PNNL, Georgia Institute of Technology, Syracuse University, Texas A&M, Egyptian Ministry of Foreign Affairs, LLNL, IAEA, Konrad Adenauer Foundation, Missouri University of Science & Technology, Old Dominion University, and UC Berkeley

2010: 30 participants (13 male, 17 female) from five countries
Schools and organizations included: MIIS, NNSA, University of Denver, LLNL, S. Rajaratnam School of International Studies (Singapore), Japanese Atomic Energy Agency, Fletcher School at Tufts University, Grinnell College, Lusher Charter School in New Orleans (teacher), IAEA, University of Maryland, George Washington University, UC Irvine, James Madison University Florence, Egyptian Ministry of Foreign Affairs, University of Illinois, University of Pittsburgh, Reed College

While the LLNL-CNS course benefits individuals pursuing careers in any aspect of international safeguards, it is geared primarily to those pursuing careers in policy and analysis. The course is designed to provide pre-service professional training for candidates for positions in the USG that shape and implement U.S. safeguards policy, such as within the NNSA Office of Defense Nuclear Nonproliferation, the State Department Bureau of International Security and Nonproliferation, and elsewhere.

Additionally, students will be well suited for analytical positions at the national laboratories and the IAEA Division of Safeguards Information Management within the Department of Safeguards. The course also helps young professionals establish relationships with potential counterparts in the field of nonproliferation.

For future safeguards technologists and inspectors, the course presents an opportunity to understand the broader political and analytical environment of the safeguards field. For example, in 2010, course organizers invited some select staff members from LLNL, including young professionals and postdoctoral fellows, to attend the course. In this respect, the course served as a professional-development effort to introduce LLNL employees to international safeguards concepts, knowledge that the employees may later leverage in their responsibilities at the laboratory.

While some course participants are continuing their graduate studies, a number have found their way into safeguards relevant fields. Several former students accepted positions in the Pacific Northwest National Laboratory-administered NNSA Nonproliferation Graduate Fellowship Program (NGFP). As NGFP fellows, students spend a year working in an NNSA Office of Defense Nuclear Nonproliferation (NA-20) office. Many of these, especially those in the Office of Nonproliferation and International Security (NA-24), support NGSI. Other course participants accepted or returned to safeguards analysis positions at the national laboratories and the IAEA. The knowledge gained by students in the LLNL-CNS course is immediately and directly put to use.

Previous Courses:

The third iteration of this course was held in June 2010. This year's course builds upon the strengths of previous iterations. What follows is a brief overview of the previous versions of this course to document the course's evolution.

2008 Pilot Course:

The Pilot Course on International Nuclear Safeguards Policy was held in Monterey in June 2008. This two-week course was organized by CNS in cooperation with DOE and LLNL. The goal of this course was to give students an understanding of the relevance of nuclear safeguards and their contribution to facilitating civil nuclear cooperation and supporting nonproliferation, as well as safeguards strengths and limitations. Furthermore, the course provided students with an overview of the interaction between different technical, legal and policy aspects of nuclear safeguards. 16 students participated in the course, 13 of whom were MIIS graduate students.

The Pilot Course covered a broad set of safeguards and safeguards-related topics. This included the history, evolution, and technical aspects of safeguards, as well as related topics such as nuclear-weapons-free-zones, the experience of working as a Junior Professional Officer at the IAEA, and regional verification mechanisms. Students were required to complete an essay on a safeguards topic as part of the course.

2009 Course:

The 2009 course featured several changes from the 2008 pilot. The course duration was shortened to one week. Course content was streamlined to include more in-depth safeguards-specific material. Some of the introductory material was moved to a new online introductory module, which ensured that students came prepared with some basic safeguards knowledge and saved valuable class time for more focused lectures.

The course consisted of a combination of lectures, discussion, and exercises. Each day the course began with a review of the previous day's discussions, prompted by questions posed to the students to highlight important safeguards concepts or challenges. Students worked on two exercises during the course. First, there was a brief open-source information analysis exercise, introduced in 2008, where students were asked to investigate the validity of a piece of information by corroborating it with other evidence. Second, the students were split into groups and asked to research and prepare a mock state evaluation report. This exercise familiarized students with the process of investigating the credibility of a state's safeguards declaration by evaluating public information about that state. At the end of the course, students presented their evaluation reports, along with recommendations for further IAEA action, to a panel of course instructors.

2010 Course Overview:

Preparatory Module:

As in 2009, Students were asked to complete an online preparatory module as a course prerequisite. The module ensured that students came to the course with a sufficient understanding of the nuclear fuel cycle and the legal underpinnings of the international nonproliferation regime. The module featured video presentations by CNS/MIIS faculty and an online quiz to ensure comprehension. The self-guided lessons, including the multimedia and quizzes, are publicly available for free on the Nuclear Threat Initiative website.[1] Students received a reading list to prepare them for the course and to serve as a bibliography of important writing on safeguards and nonproliferation. Many of the readings were selected from the safeguards textbook *Nuclear Safeguards, Security and Nonproliferation*, developed with NGSI funding.[2]

The Course Agenda:

As in 2009, the course agenda focused on the history and evolution of the legal and technical aspects of international safeguards policy and information analysis. A complete agenda is included in the appendix. The course was organized in a roughly

[1] http://www.nti.org/h_learnmore/h5_study_guides.html
[2] James E. Doyle, ed., Nuclear Safeguards, Security, and Nonproliferation: Achieving Security with Technology and Policy (Boston: Butterworth-Heinemann, 2008).

chronological manner. Students were first introduced to the origins of international safeguards and the foundation of NPT safeguards. Students were then introduced to facility-level inspection and verification techniques used to implement comprehensive safeguards before the introduction of the Additional Protocol.

Following the discussion of safeguards modeled after IAEA INFCIRC/153, the course presented case studies that challenged the international safeguards system, including Iraq, South Africa, and the DPRK. These lectures led to discussion of the development of strengthened safeguards and the Model Additional Protocol (INFCIRC/540). After strengthened safeguards, students were presented with the concept of the state-level approach and various technologies and data streams used to investigate indications of undeclared activity at the state-level.

The final set of lectures covered current safeguards issues. These included case studies of states with outstanding safeguards concerns (Iran and Syria), discussion of the challenges associated with the emphasis on "information-driven" safeguards, issues of safeguards and nuclear supply, and a discussion of future safeguards issues.

In addition to the lectures, the course agenda included several supplementary sessions. These included a panel discussion of careers in international safeguards, and social events that allowed for informal interaction between students and instructors. Also, students and instructors participated in a special presentation of the recently concluded 2010 NPT Review Conference, including unique insights and implications for safeguards. CNS staff in attendance at the RevCon hosted this lunch. A number of CNS staff members served on a variety of national delegations and were able to offer some behind-the-scenes observations and analysis.

The most significant change to the course was the improvement and expansion of the course exercises. The course featured two exercises which will be described in some detail: a state evaluation exercise and an IAEA Board of Governors simulation.

State Evaluation Exercise:

After collecting feedback from 2009 participants, the State Evaluation Exercise was modified for 2010 because course instructors felt that significant improvements could be made. In 2009, students were divided into three groups and asked to conduct open-source research on a state's nuclear program. Each group was tasked with researching a different state. Students organized that information into a mock state evaluation report, and delivered it in hour-long, power-point presentations to their peers. As a result, large portions of class time were devoted to the exercise. Students devoted too much time to data collection, compilation, and organization and not enough time on analysis.

The State Evaluation Exercise was intended to enhance student understanding of the information analysis processes that are performed in the course of IAEA state

evaluation. Therefore, in revising the exercise for 2010, course organizers sought to design the exercise in a way that would emphasize analysis and challenge students to make credible recommendations for IAEA follow-up activities. For 2010, the exercise was shortened and sharpened. Instructors split the class into more groups with fewer students in each group.

Students conducted the mock IAEA State Evaluation by analyzing a set of provided documents simulating several different types of information relevant to the task of assessing a state's nuclear program, including state declared, IAEA derived, open source, and other information. Because students were provided with this virtual "state file," they did not need to dig up information on the internet. Instead, their efforts were devoted to evaluating the information at hand. Included in the information provided were mock representations of IAEA derived information (such as inspection reports and environmental sampling results) and third party information. This additional information was seeded with inconsistencies for students to uncover and reconcile with other information about their state. The objective was for participants to identify proliferation pathways, recognize possible inconsistencies, understand tools available under the state's safeguards agreement (a state without an Additional Protocol was specifically selected for this purpose), and recommending follow-up action for the Department of Safeguards.

Course instructors changed the exercise deliverable for 2010. Rather than require a formal presentation, instructors determined it a more effective use of class time to engage in a plenary discussion of group findings. Because the student groups analyzed the same country, they were able to compare their analyses and proposed solutions. This produced a more dynamic result that maintained active student participation throughout. Course instructors helped students to understand how the IAEA conducts investigations while operating under legal, budgetary, and other constraints. Thus, the course demonstrated for students the challenges and techniques that were discussed in course lectures.

IAEA Board of Governors Simulation:

The IAEA Board of Governors (BOG) simulation was a new exercise added for the 2010 course. Course organizers determined that an exercise demonstrating different state perspectives on international safeguards would be helpful in the overall effort of teaching international safeguards policy.

Pairs of students represented Governors at a meeting of the IAEA BOG. Given the normal differences between the Governors in areas such as geographic representation or nuclear fuel cycle development, it was guaranteed that the simulated BOG would represent a variety of competing perspectives.

Students were asked to consider a draft resolution calling on a state with outstanding safeguards compliance issues to enhance its cooperation with the IAEA. By design, the resolution contained "strong" language that generated debate—and

active negotiations on the margins of the meeting—among the different governors. After presenting their state's position on the issue at hand, and after submitting changes to the draft text, students were asked to put the resolution to a vote.

Student Evaluations and Reactions

Eighteen students out of 30 enrolled completed the online evaluation survey offered during the course via SurveyMonkey (yielding a response rate of 60%). The respondents gave the course an overall rating of 4.22 on a scale of 1 (poor) to 5 (excellent), indicating a high level of satisfaction. Strong majorities of students rated the length (72%) and difficulty (94%) as "about right" and rated the readings (72%) and lecture presentations (67%) as very useful (the highest rating for those questions), indicating that the course as refined over three years may be regarded as a well-proven design. A majority of students (61%) also rated the simulation exercises as very useful, a strong evaluation considering that the exercises in 2010 were either entirely new or extensively redesigned from previous years. Open-ended comments provided a wide range of suggestions for further refinements to the course, outstanding among which were clarification of the scope and objectives of the state evaluation exercise and earlier provision of readings and other materials through the online preparation module.

Comparative Student Evaluations

	2008	**2009**	**2010**
Survey response rate	88%	53%	60%
Overall course rating (0-5)	4.00	4.19	4.22
Course length (% responding "about right")	64%	81%	72%
Course difficulty (% responding "about right")	79%	81%	94%
Utility of readings (% responding "very useful")	36%	38%	72%
Utility of lectures (% responding "very useful")	71%	69%	67%
Utility of simulation exercises (% responding "very useful")	36%	31%	61%
Improved knowledge or skill with subject (0-5)	3.86	4.13	4.17
Increased interest in subject (0-5)	4.14	3.56	4.11
Increased desire to pursue subject further (0-5)	4.00	3.81	4.17
Overall contribution to learning (0-5)	4.21	3.88	4.22

Goals for Next Year:

The results of the 2010 LLNL-CNS safeguards course underscore the potential for future courses in developing the safeguards workforce and promoting careers in safeguards policy. With continued support from NGSI, LLNL and CNS hope to offer the course in 2011 and to expand, explore and refine a number of aspects, including:

- Expanding outreach to students and young professionals in the United States and globally
- Offering a version of the course for graduate credit at MIIS (transferrable to other universities)
- Expanding readings and other materials available online and refining the quiz and other aspects of the preparatory module
- Continuing improvement of simulation exercises
- Adding interactive elements to presentations
- Expanding opportunities for mentoring and peer coaching

Appendix: List of Course Speakers and Presentations

- Overview and Course Objectives
  Fred Wehling, Monterey Institute of International Studies (MIIS)
- Origins of International Safeguards
  Fred Wehling, MIIS
- Foundations of Nuclear Nonproliferation Treaty Safeguards
  Jean Maurice Crété, International Atomic Energy Agency (IAEA)
- Organization of the International Safeguards System
  Justin Reed, Lawrence Livermore National Laboratory (LLNL)
- Traditional Safeguards Implementation
  Mark Schanfein, Idaho National Laboratory (INL)
- Safeguards Technology for Inspections at the Facility Level: Past, Present, and Future
  Mark Schanfein, INL
- Challenges to International Safeguards in the 1990s: South Africa and Iraq
  Richard Hooper, Wind River Consulting
- Challenges to International Safeguards in the 1990s: DPRK
  George Anzelon, LLNL
- Strengthened Safeguards Part 1
  Richard Hooper, Wind River Consulting
- Strengthened Safeguards Part 2
  Richard Hooper, Wind River Consulting
- Global Perspectives on International Safeguards
  Jean Maurice Crété, IAEA
- Current Safeguards Challenges: Syria
  Jonathan Essner, LLNL
- The State Level Approach and the State Evaluation Process

Richard Wallace, Los Alamos National Laboratory (LANL)

- The Information Revolution and Safeguards
  Richard Wallace, LANL
- Analysis-Driven Safeguards: Policy, Prioritization, Management, and Human Capital Challenges
  Jean Maurice Crété, IAEA
- Panel Discussion and Q&A: Working in International Safeguards
  Moderator: Fred Wehling, MIIS
- Safeguards and Supply
  Bill Domke, LLNL
- Current Safeguards Challenges: Iran
  Chris Carson, LLNL
- Special Lunch Discussion: The 2010 NPT Review Conference and Implications for Safeguards
  Gaukhar Mukhatzhanova, MIIS
- Future of Safeguards
  Thomas Shea, TomSheaNuclear Consulting

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